

REMARKS

Claims 1-30 and 35 are currently pending in the application. By this amendment, claim 1 is amended for the Examiner's consideration. The above amendments do not add new matter to the application and are fully supported by the specification. For example, support for the amendment to claim 1 is provided in original claim 1 and at paragraph 0026 of the specification. Reconsideration of the rejected claims in view of the above amendments and the following remarks is respectfully requested.

Allowable Subject Matter

Applicants appreciate the indication that claims 2-4 contain allowable subject matter and would be allowable if presented in independent form. However, at this time, Applicants are not presenting claim 2 in independent form and respectfully submit that all of the claims are in condition for allowance for the following reasons.

35 U.S.C. §102 Rejection

Claim 1 (and presumably claim 35) was rejected under 35 U.S.C. §102(e) for being anticipated by U. S. Published Patent Application No. 2002/0081855 to JIANG et al. This rejection is respectfully traversed.

In order to establish a *prima facie* case of anticipation under 35 U.S.C. § 102, a single prior art reference must disclose each and every element as set forth in the subject claim. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ 2d 1051, 1053 (Fed. Cir. 1987). Applicants respectfully submit that a *prima*

facie case of anticipation cannot be established because JIANG fails to teach each and every element of the claims.

The claimed invention is directed to a method for reducing resist poisoning. The method includes forming a first structure in a dielectric on a substrate, reducing amine related contaminants from the dielectric and the substrate prior to the formation of a second structure on the substrate such that the amine related contaminants will not diffuse out from either the substrate or the dielectric. The reducing utilizes a plasma treatment which one of chemically ties up the amine related contaminants and binds, traps, or consumes the amine related contaminants during subsequent processing steps. The second structure is formed on the substrate, and after the forming of the first structure, the process prevents poisoning of a resist layer in subsequent processing by the reducing. This method is not disclosed, or even suggested, by JIANG.

The Examiner explains that paragraphs [0013] and [0021] – [0025] of JIANG disclose reducing amine related contaminants from the dielectric and the substrate prior to a formation of a second structure on the substrate, wherein the reducing utilizes a plasma treatment which one of chemically ties up the amine related contaminants and binds, traps, or consumes the amine related contaminants during subsequent processing steps. Applicants respectfully disagree.

Paragraph [0013] of JIANG merely states the following:

[0013] In order to reduce or eliminate the resist poisoning, an in-situ plasma ash and treatment is performed. In the preferred embodiment, an O₂ plasma is used. Alternatively, other plasma chemistries such as H₂, H₂O, H₂O₂, O₃, CO, CO₂, SO₂, etc. may be used with or without gas additives like Ar or He.

While such language discusses the use of plasma treatment to affect resist poisoning, such language is entirely silent with regard to reducing amine related contaminants in each of the substrate and the dielectric. Nor does it even remotely disclose that the amine related contaminants are reduced from the dielectric and the substrate prior to a formation of a second structure on the substrate using a plasma treatment. Additionally, such language is entirely silent with regard to the plasma treatment chemically tying up the amine related contaminants and binds, traps, or consumes the amine related contaminants during subsequent processing steps. Finally, this language does not disclose, or even suggest, that the amine related contaminants will not diffuse out from either the substrate or the dielectric.

Furthermore, paragraphs [0021] – [0025] of JIANG merely state the following:

[0021] An O₂ plasma is preferably used for the plasma treatment. However, other chemistries, such as those involving H₂, H₂O, H₂O₂, O₃, CO, CO₂, or SO₂, etc. with or without inert gases like Ar or He, may alternatively be used. Analysis of RIE O₂ plasma treated low-k films revealed some carbon depletion, but no significant damage to the OSG film. Care should be taken to limit oxidation so as not to damage the low-k film.

[0022] An advantage of the invention is improved throughput. The plasma treatment removes (ashes) the resist of via pattern 130 and functions as a wafer clean in addition to eliminating resist poisoning. Thus, the in-situ process reduces the overall via etch and clean time.

[0023] The plasma treatment should be performed immediately after the via etch. An advantage of the invention is that the source of poisoning (e.g., N that is adsorbed on the resist and via sidewall) is removed immediately after the etch. This minimizes the time that the wafers are exposed to the poisoning source and also prevents any poisoning reactions that may be enhanced by moisture exposure.

[0024] In order to protect the bottom of via 106 during the subsequent trench etch, via 106 may be partially or completely filled. For example, an organic BARC

(bottom anti-reflection coating) 107 may be deposited over the structure and etched back such that BARC material remains only in the via 106.

[0025] Next, a trench pattern 132 may be formed over IMD 104, as shown in FIG. 1D. An in-situ plasma ash/treatment after via etch reduces or eliminates the poisoning problem at trench pattern. With a SiO₂ capping layer 105 or no capping layer, both in-situ and ex-situ O₂ plasma ash show no resist poisoning. When a SiC capping layer 105 is used, a flood exposure after via clean shows a clear difference among in-situ O₂ plasma ash, ex-situ O₂ plasma ash and a H₂/Ar plasma ash. The exposure energy required to clear resist inside a via is the lowest for the wafer with in-situ O₂ plasma ash, indicating the most robustness for fighting poisoning.

Again, while such language discusses the use of plasma treatment to affect resist poisoning, such language is entirely silent with regard to reducing amine related contaminants in each of the substrate and the dielectric. Nor does it even remotely disclose that the amine related contaminants are reduced from the dielectric and the substrate prior to a formation of a second structure on the substrate using a plasma treatment. Additionally, such language is entirely silent with regard to the plasma treatment chemically tying up the amine related contaminants and binds, traps, or consumes the amine related contaminants during subsequent processing steps. Finally, this language does not disclose, or even suggest, that the amine related contaminants will not diffuse out from either the substrate or the dielectric.

Applicants emphasize, in particular, that because JIANG discloses using plasma treatment between steps 1C and 1D (see paragraphs [0019] – [0025]) and because step 1C utilizes an etch stop layer 101 over the substrate 100, it is not apparent that the plasma treatment would chemically tying up the amine related contaminants and bind,

trap, or consume the amine related contaminants of each of the substrate and the dielectric.

Furthermore, the rejection of claim 35 is improper at least because this claim depends from claim 1, which is believed to be allowable over the applied art of record.

Accordingly, Applicants respectfully request that the rejection over claims 1 and 35 be withdrawn.

Rejoinder of Withdrawn Claims

Applicants submit that because claim 1 is now allowable, rejoinder of at least claims 5-12 and allowance of the same is now proper at least because they depend from claim 1.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants submit that all of the claims are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicant hereby makes a written conditional petition for extension of time, if required.

P27172.A04

Application Serial No. 10/605,926

Please charge any deficiencies in fees and credit any overpayment of fees to
Deposit Account No. 09-0456.

Respectfully submitted,
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A handwritten signature in black ink, appearing to read 'Andrew M. Calderon', with a large, stylized flourish extending to the left.

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March 28, 2006
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